

ANN

Unit 4

Veterinary Science Optional

4. Feed additives, methane inhibitors, probiotics, enzymes, antibiotics, hormones, oligosaccharides, antioxidants, emulsifiers, mould inhibitors, buffers etc. and Use and abuse of growth promoters like hormones and antibiotics – latest concepts:

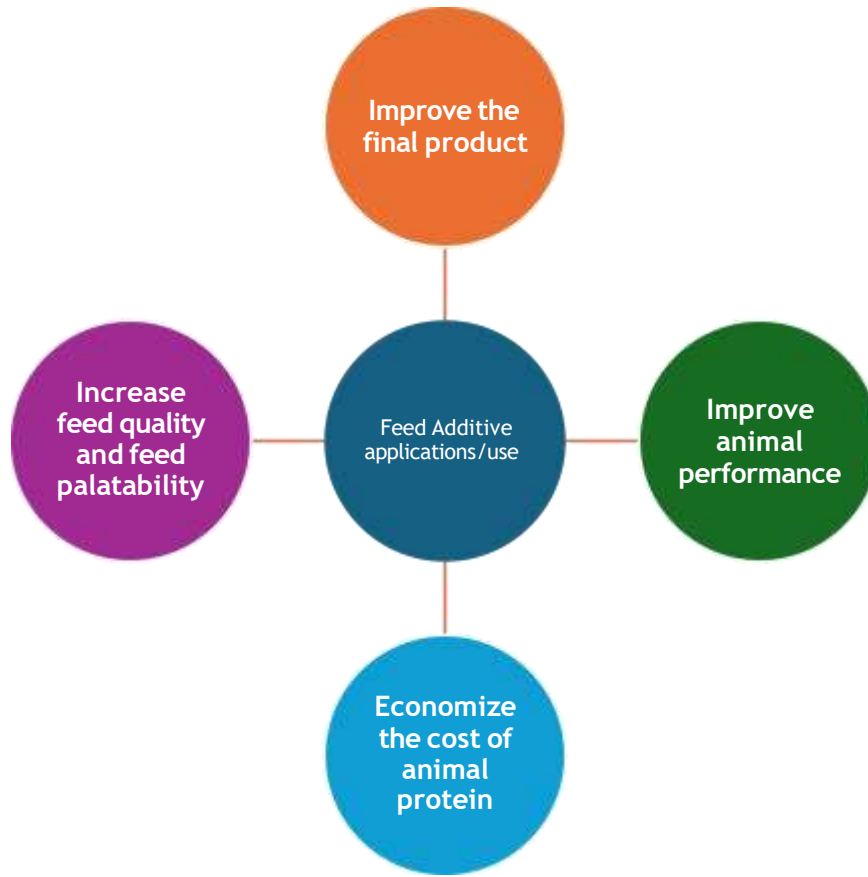
UPSC PYQs

1.

1. Enumerate the enzymes used as feed additives in animal nutrition. What precise benefits does each of these enzymes offer to the animal? What properties must these enzymes possess if they are to be effective when incorporated into an animal's diet? (2012)
2. Define the term growth promoter. Discuss the various growth promoters used in ruminant and poultry rations, citing their mechanisms, favorable effects and possible ill-effects? (2012)
3. What do you understand about feed supplements and feed additives? Describe various groups of additives used in animal feed? (2013)
4. Define probiotics. Enlist important microorganisms which are used as probiotics and also discuss the characteristics of good probiotics? (2014)
5. Many non-nutritive substances are often being mixed in animal and poultry ration as growth promoters. Discuss the uses and abuses of these growth promoters? (2016)
6. Differentiate between probiotics and prebiotics? (2018)
7. What are natural antioxidants? Describe the role of antioxidants in the animal body? (2021)
8. Enlist the various feed additives and describe the merits of use of probiotics in animal ration? (2022)
9. Write a short note on prebiotics as a feed additive? (2023).

Feed additives

Feed additives are substances, microorganisms, or preparations intentionally added to animal feed or water in small quantities to perform specific functions such as improving feed quality, enhancing animal performance and health, or benefiting food product quality from animals..

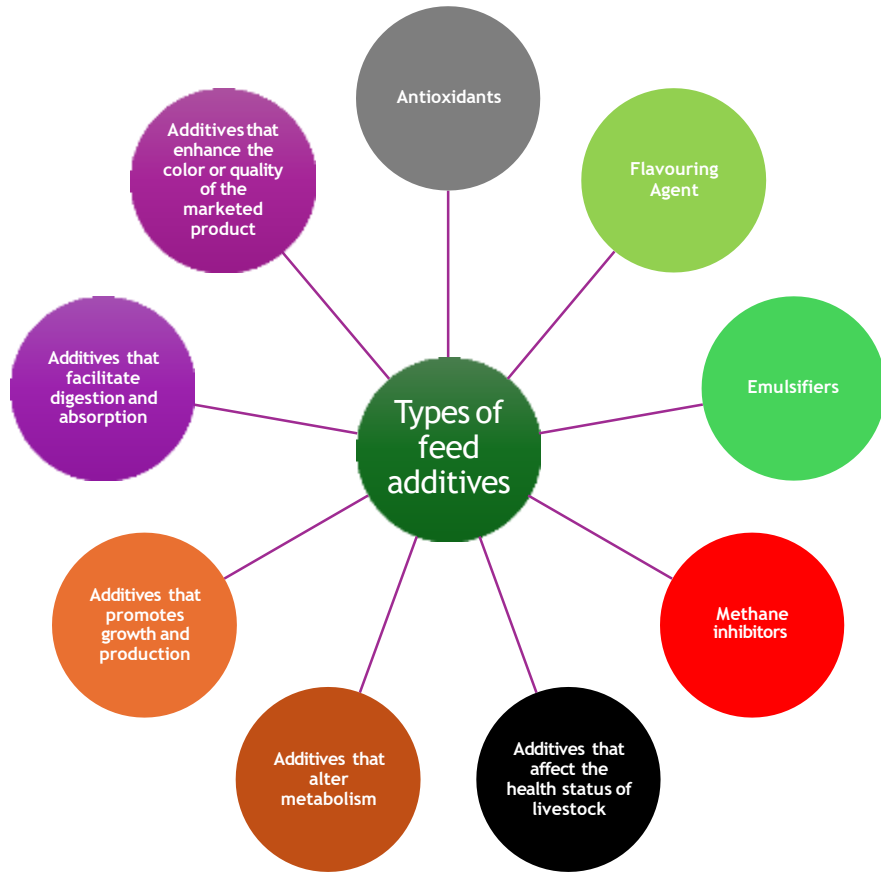


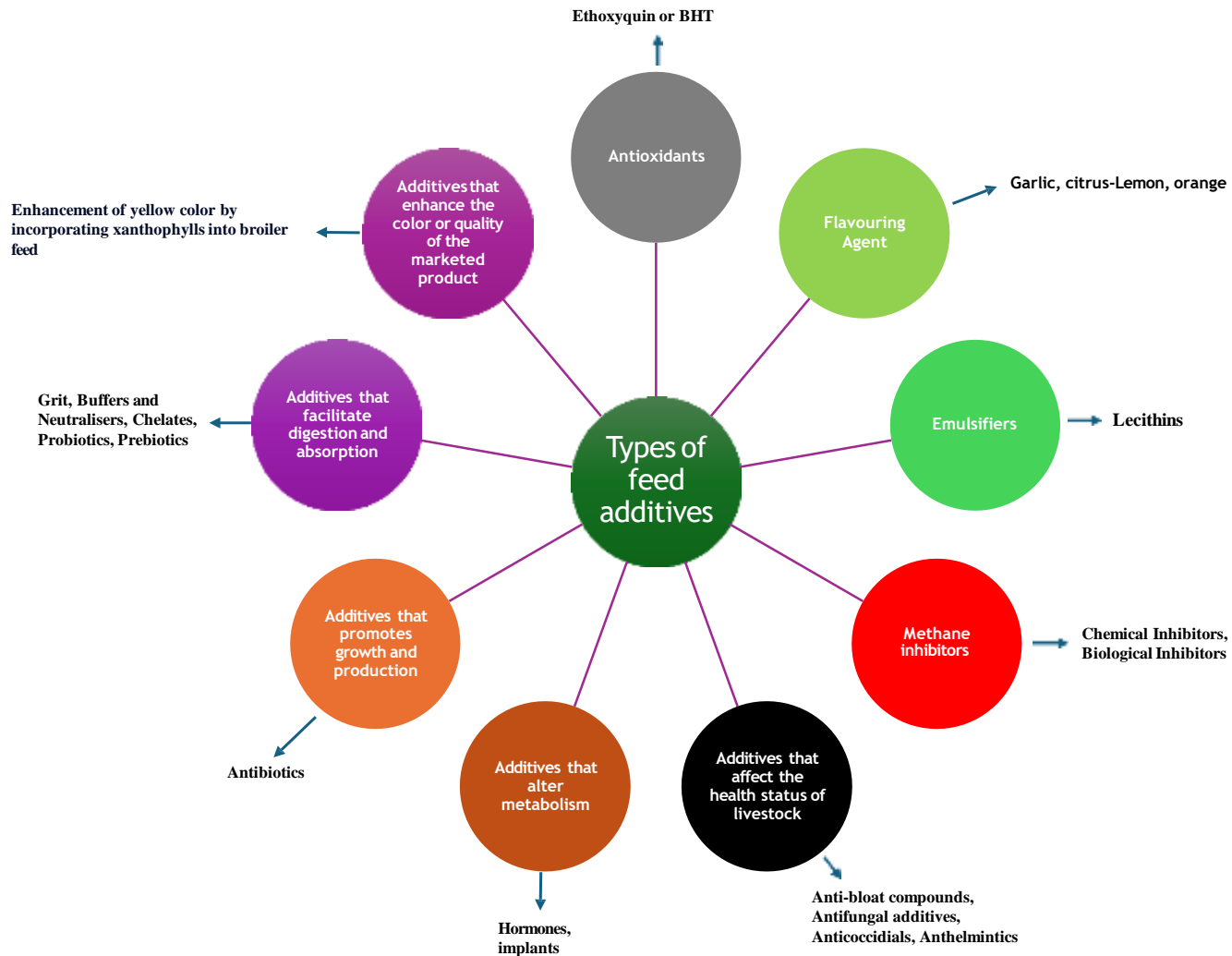
Enhance Feed Quality: Emulsifiers and pelleting agents improve feed quality, while antioxidants and preservatives extend feed shelf-life.

Boost Animal Performance: Feed additives, used in non-therapeutic amounts, promote growth, reduce feed intake, and protect against environmental stressors.

Upgrade Final Products: Antioxidants in animal diets slow fat rancidity, producing higher-quality, more consistent meat

Reduce Animal Protein Costs: Growth promoters like antibiotics in feed increase animal protein production efficiency, lowering the cost of meat, milk, and eggs for consumers.





- 1. Antioxidants**
- 2. Flavouring Agent**
- 3. Additives that enhance the color or quality of the marketed product**
- 4. Additives that facilitate digestion and absorption**
- 5. Enzymes**
- 6. Prebiotics**
- 7. Additives that promotes growth and production**
- 8. Additives that alter metabolism**
- 9. Additives that affect the health status of livestock**
- 10. Methane inhibitors**
- 11. Emulsifiers**

1. Antioxidants

Antioxidants are compounds that prevent oxidative rancidity of polyunsaturated fats. Rancidity once developed, may cause destruction of vitamins A, D and E and several of the B complex vitamins. **Ethoxyquin or BHT** (butylated hydroxytoluene) can serve as antioxidants in feed.

Essential functions:

- 1. Protection Against Oxidative Damage**
- 2. Maintaining Cellular Health.**
- 3. Supporting Immune Function**

2. Flavouring Agent

To increase palatability and feed intake

3. Additives that enhance the color or quality of the marketed product

Enhancement of yellow colour by incorporating xanthophylls into broiler feed. Among various additives, arsanilic acid, sodium arsanilate and roxarsone are added for the purpose.

4. Additives that facilitate digestion and absorption

1. Grit is added to supply surface for grinding within the gizzard. Oyster shells, coquina shells and limestone are used as grit.

2. Buffers and Neutralisers: Addition of buffers and neutralisers, such as carbonates, bicarbonates, phosphate salts, ammonium chloride and sodium sulfate have been used in such conditions.

3. Chelates: Prior to union with the metal, the organic substances are termed as “ligands”. Ligand + mineral = chelate element. Chelates may be of naturally occurring substances such as chlorophyll, cytochromes, hemoglobin, vitamin B12, some amino acids, etc., or may be of synthetic substances like ethylenediaminetetraacetic acid (EDTA.)

4. Probiotics: live microbial feed supplement which beneficially affects the host animals by improving its intestinal microbial balance. The probiotic preparations are generally composed of organisms of lactobacilli and/or streptococci species; few may contain yeast.

Characteristics of a Good Probiotic:

- 1.The culture should exert a **positive effect** on the host. It should be gram positive, acid resistant.
- 2.The culture should possess a high **survival rate** and multiply faster in the digestive tract. It should be strain specific.
- 3.The culture microorganisms should be **neither pathogenic nor toxic** to the host.
- 4.The **adhesive capability** of microorganisms must be firm and faster. Be **durable** enough to withstand the stress of commercial manufacturing, processing and distribution so that the product can be delivered alive to the intestine.

5. Enzymes

Enzymes are proteins, which have the property of catalyzing specific biochemical reactions. Poultry feeds are largely composed of plant and vegetable materials and there are enzymes developed to degrade, modify or extract the plant polymers found in some of the cereals and their by-products.

Different type of enzymes

1. **Phytase**
2. **Protease**
3. **Amylase**
4. **Cellulase**
5. **Lipase**

6. Prebiotics

- Non-digestible food ingredients that stimulate growth of desirable bacteria in GIT.
- They modify the balance of the microflora population & thereby provide a healthier intestinal environment. Examples: Oligosaccharides and inulin.

Source:

- Soya bean meal, rapeseed meal & legumes contain-galactooligosaccharides (GOS)
- Cereals contain fructo-oligosaccharides (FOS);
- Milk products have trans-galactooligosaccharides (TOS)

They can selectively stimulate the growth and activity of beneficial gut microorganisms.

1. Additives that promotes growth and production

Antibiotics: These are substances which are produced by living organisms (mould, bacteria or green plants) and which in small concentration have bacteriostatic or bactericidal properties.

Types of Antibiotics Used:

- Tetracyclines:** Examples include oxytetracycline and chlortetracycline.
- Ionophores:** These are not used in human medicine and include compounds like monensin and lasalocid.
- Penicillins:** Some formulations may include antibiotics like penicillin.

Benefits of Antibiotic Feed Additives:

1.Improved Growth: Antibiotics can enhance growth rates, resulting in larger and more valuable animals.

2.Disease Prevention: Subtherapeutic doses of antibiotics can prevent common infections and diseases in crowded or stressful production environments.

3.Enhanced Feed Efficiency: Antibiotics can improve the efficiency of converting feed into meat, milk, or eggs, which can reduce production costs.

8. Additives that alter metabolism

1.Hormones: Extensive use is being made of synthetic and purified estrogens, androgens, progestogens, **growth hormones** and thyroxine or **thyroprotein (iodinated casein)** to stimulate the growth and fattening of meat producing animals. There is concern, however, about possible harmful effects of any residues of these materials in the meat or milk for the consumers.

Implants: Implants are hormone or hormone like products that are designed to release slowly, but constantly, the active chemicals for absorption into the bloodstream. These are implanted subcutaneously in the ear.(eg.) **diethylstilbestrol (DES).**

Benefits of Hormonal Feed Additives:

- Increased Growth Rate:** Hormones promote faster growth and weight gain in animals, leading to reduced time to market.
- Improved Feed Efficiency:** Hormonal additives enhance the efficiency of converting feed into meat, milk, or other animal products.
- Reduced Fat Content:** Hormones can lead to a decrease in fat deposition and an increase in lean muscle mass in animals.

9. Additives that affect the health status of livestock

1. **Antibloat compounds:** Surfactants such as poloxalene is used as a preventive for pasture bloat
2. **Antifungal additives:** Nystatin and copper sulfate preparations
3. **Anticoccidials:** protozoa which live inside the cells of the intestinal lining of livestock.
4. **Anthelmintics:**The compounds act by reducing parasitic infections.

10. Methane inhibitors

Types of Methane Inhibitors:

- Chemical Inhibitors:** These are compounds that can reduce methane production in the rumen. Common examples include 3-NOP (3-Nitrooxypropanol) and nitrate.
- Biological Inhibitors:** Certain microorganisms can be added to the rumen to reduce methane production. For example, archaea like Methanobrevibacter can be targeted.

Mechanism of Action: Methane inhibitors work by disrupting the microbial processes in the rumen that produce methane gas. They can inhibit specific enzymes or microorganisms responsible for methane formation.

•**Benefits:** Reducing methane emissions can be environmentally beneficial as it mitigates the impact of livestock on climate change. Methane inhibitors may also improve feed efficiency and nutrient utilization in animals, potentially leading to better animal performance.

Challenges: Methane inhibitors should be used with caution, as they can alter the microbial balance in the rumen and affect the overall digestive process.

11. Emulsifiers

Emulsifiers are substances used in animal nutrition as feed additives to enhance the mixing and dispersion of fat and water in feed, making it easier for animals to digest and utilize dietary fats.

Types of Emulsifiers Used:

1.Lecithins: Lecithins are naturally occurring emulsifiers found in ingredients like soybeans and eggs. They contain phospholipids that can help disperse fats in water.

2.Mono- and Diglycerides: These emulsifiers are often derived from animal or vegetable fats and are commonly used in feed and food applications.

Mechanisms of Action: The primary mechanism of action of emulsifiers is their ability to reduce the surface tension between fat and water phases, allowing them to mix more easily.

Benefits of Emulsifier Feed Additives:

1.Improved Fat Digestion: Emulsifiers facilitate the digestion of dietary fats by breaking them down into smaller droplets, which increases the surface area for enzymatic digestion.

2.Increased Feed Palatability: Emulsifiers can enhance the palatability of feed, making it more attractive to animals and encouraging greater feed intake.

3.Stable Feed Formulations: Emulsifiers help maintain the stability of feed formulations, preventing phase separation and ensuring uniform distribution of nutrients.

Ruminant Growth Promoters:

- 1. Hormonal Implants:** Estradiol, testosterone, and their synthetic analogues (e.g., zeranol, trenbolone acetate) are commonly used hormonal implants that improve growth rates and feed efficiency in cattle.
- 2. Beta-Agonists:** Compounds like **ractopamine** are beta-agonists that enhance muscle growth and carcass yield when fed during the final weeks before slaughter. beta-agonists stimulate lipolysis (fat breakdown) and inhibit lipogenesis (fat synthesis), leading to leaner carcasses.
- 3. Ionophores:** **Monensin**, lasalocid, and laidlomycin propionate are ionophore antibiotics that shift ruminal fermentation to promote energy availability, improving feed efficiency.

4. Antimicrobials: Tylosin and virginiamycin

Antimicrobials like tylosin and virginiamycin are used in cattle feed for both therapeutic and growth-promoting purposes.

Tylosin is an antibiotic primarily used to prevent liver abscesses in feedlot cattle. It's effective against the bacteria responsible for liver abscesses (*Fusobacterium necrophorum* and *Trueperella pyogenes*). By reducing liver abscesses, tylosin improves overall animal health and performance.

Virginiamycin is a streptogramin antibiotic that, like ionophores, modifies ruminal fermentation. It increases propionate production and reduces lactic acid accumulation in the rumen, helping to prevent acidosis. Virginiamycin can improve feed efficiency by 3-5% in cattle.

Poultry Growth Promoters:

- 1. **Antibiotics:** antibiotics like tetracyclines and penicillins used as growth promoters in poultry feed due to their ability to enhance growth and prevent diseases.
- 2. **Coccidiostats:** Coccidiostats like ionophores and non ionophores play a crucial role in poultry farming by controlling and preventing coccidiosis.
- 3. **Hormones:** Hormones such as growth hormone and various synthetic analogs have been used to promote growth in poultry.
- 4. **Probiotics, Prebiotics and Enzymes**

Growth Promoters

